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DOI:

[10.1016/j.psychres.2014.12.034](https://doi.org/10.1016/j.psychres.2014.12.034)

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Document Version

Peer reviewed version

Citation for published version (Harvard):

Bo, S, Kongerslev, M, Dimaggio, G, Lysaker, PH & Abu-akel, A 2015, 'Metacognition and general functioning in patients with schizophrenia and a history of criminal behavior', *Psychiatry Research*, vol. 225, no. 3, pp. 247-253. <https://doi.org/10.1016/j.psychres.2014.12.034>

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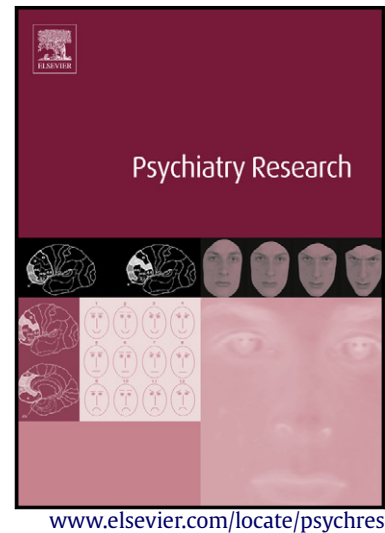
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PII: S0165-1781(14)01027-0
DOI: <http://dx.doi.org/10.1016/j.psychres.2014.12.034>
Reference: PSY8701

To appear in: *Psychiatry Research*

Received date: 22 May 2014
Revised date: 9 November 2014
Accepted date: 21 December 2014

Cite this article as: Sune Bo, Mickey Kongerslev, Giancarlo Dimaggio, Paul H. Lysaker, Ahmad Abu-Akel, Metacognition and general functioning in patients with schizophrenia and a history of criminal behaviour, *Psychiatry Research*, <http://dx.doi.org/10.1016/j.psychres.2014.12.034>

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Metacognition and general functioning in patients with schizophrenia and a history of criminal behaviour

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Abstract

Metacognitive difficulties have been linked to social dysfunction in schizophrenia. However, research examining the role of metacognition in the social functioning of patients with a history of violence and criminality is very limited. This research is especially important for this group given their relatively poor prognosis and their risk to reoffend, as well as the promising benefits of integrating metacognitive approaches in psychosocial treatments. In this study, the association between metacognition and global social functioning was examined in 79 patients with schizophrenia with a criminal background. We also examined the association of positive, negative and disorganized symptoms with social functioning and the extent to which metacognition mediates this association. The results indicate that poor social functioning is associated with metacognitive difficulties and higher levels of delusions and conceptual disorganization. In addition, mediation analyses showed that metacognition accounted for about 11% of the total effect size of the association between delusions and social dysfunction, suggesting that the relationship between delusions and social dysfunction is partially driven by impaired metacognition. These findings underscore the importance of interventions designed to enhance the patients' metacognitive capacities, that is, the more proximal capacities linked to poorer social functioning.

Keywords:

Mentalizing, Social functioning, Psychosis, Psychotic symptoms

1. Introduction

Impairments in psychosocial functioning are characteristic features of schizophrenia spectrum disorders (Bellack et al., 1990). These include reduced levels of self care (Brüne et al., 2011), vocational functioning (Lysaker et al., 1994) and social relationships (Penn et al., 1997; Roberts and Penn, 2013) all of which not only reduce the patients' quality of life but also negatively influence the prognosis of the disorder and serve as a risk factor for relapse and the development of comorbid psychopathology (Perlick et al., 1992; Sullivan et al., 1990; Tien and Eaton, 1992). In light of findings showing that only a small proportion of the variance in psychosocial functioning in schizophrenia is explained by the conventional symptomatology described within the diagnostic systems (Ertuğrul and Uluğ, 2002; McGurk and Meltzer, 2000; Rabinowitz et al., 2012), efforts have been underway to understand the more subtle causes of psychosocial deficits in this population. These efforts point to possible mediating variables that could explain the association between symptom severity and psychosocial functioning in schizophrenia.

One such possible mediating variable that could explain the link between psychotic symptoms and psychosocial functioning is the capacity to recognize and reason about self and other mental states. Difficulties in this capacity are often associated with failures to understand mental states and are apparent when engaged in both emotionally and unemotionally arousing interactions during the pursuit of personal goals (Liotti and Gilbert, 2011). In this paper, we will refer to the reflections people form about themselves and others as metacognition. Specifically, metacognition refers to a spectrum of mental activities that involves thinking about thinking, ranging from more discrete acts in which people recognize specific thoughts and feelings to more synthetic acts in which an array of intentions, thoughts, feelings, and connections between events are integrated into larger complex representations (Lysaker et al., 2013; Semerari et al., 2007; Semerari et al., 2003).

Although metacognition has been considered a part of social cognition (Pinkham et al.,

2013), one operational difference is that metacognition includes many different aspects, ranging from the ability to recognize specific aspects of subjective experience such as an emotion or a belief, to more synthetic aspects such as the ability to reason about the cause-effect links between different mental states or the ability to maintain a sense of unity and thus an understanding of different aspects of internal experience. At issue with respect to synthetic forms of metacognition is not specifically what one thinks or correctly notices, but is instead whether basic elements of experience are recognized and then synthesized into meaningful wholes. Synthetic metacognitive acts also affect life in a different manner than do specific beliefs or singular judgments, in that they lend meaning to events, and thus, supply reasons as to *why* one carries out a certain act, as well as premises for deciding *what* is the best course of action to resolve dilemmas encountered in daily interactions (Lysaker et al., 2013). As such, metacognitive capacities are essential for the understanding of *cognitive* and *affective* mental states (Abu-Akel and Shamay-Tsoory, 2011; Semerari et al., 2003), the management of distress (Weiss et al., 2006) and empathy (Blair, 2005; Shamay-Tsoory et al., 2010).

Deficits in metacognition have been found in many schizophrenia samples, both in earlier and later phases of the illness (Vohs et al., 2014a; Lysaker et al., 2005; AbuAkel and Abushua'leh, 2004; Ang and Pridmore, 2009; Bora et al., 2009; Brune, 2005; Chung et al., 2013; Frith, 2004; Hamm et al., 2012; Harrington et al., 2005; Lysaker et al., 2011; Lysaker et al., 2014). For example, it has been shown that patients with schizophrenia have lesser capacities for metacognition compared with participants with chronic non-psychiatric conditions and at least two other prolonged psychiatric conditions (PTSD and substance abuse) (Lysaker et al., 2014). In addition, studies consistently report a link between schizophrenia and social dysfunction, which has been attributed by some to the presence of metacognitive difficulties. However, studies linking metacognition and poor social functioning in schizophrenia have drawn on small sample sizes and

did not systematically control for essential confounding factors such as the presence of co-morbid clinical syndromes (i.e. depression, anxiety, bi-polar disorders, drug and alcohol dependence etc.), socio-demographic factors (i.e. gender, age, educational level, socioeconomic status, ethnicity), and the influence of present state emotional arousal at the time of assessing metacognitive abilities, which has been shown to affect metacognitive performance (Bateman and Fonagy, 2011).

Moreover, there are a limited number of studies that examined the role of metacognition in understanding criminal behaviour in patients with schizophrenia (Bo et al., 2013), and to the authors' knowledge, there is only one study to date that explored the relationship of metacognition with past history of violence in patients with schizophrenia (Mitchell et al., 2012). Determining the role of metacognition in functional outcome is thus especially important for this group given their relatively poor prognosis and their potential to reoffend (Witt et al., 2013). Research has also suggested that metacognition may be addressed in a range of psychosocial treatments (Lysaker et al., 2010; Salvatore et al., 2012) and so confirmation of the role of metacognitive deficits in social dysfunction in this group could offer important possibilities for treatment and recovery.

In the current study, we extended this work by accounting for these limitations and examined the nature of the association of metacognition with global social functioning in a relatively large sample of primarily criminal and violent patients with schizophrenia. Specifically, we tested the following four hypotheses. First, we predicted that lower levels of social functioning were associated with decreased metacognition. Second, we predicted that poor metacognition was associated with symptom severity. Based on previous work, we predicted that deficits in metacognition would be specifically associated with the negative symptoms blunted affect and emotional withdrawal (Nicolò et al., 2012; Mitchell et al., 2012; Hamm et al 2012; Rabin et al., 2014; Mcleod et al., 2013), the positive symptoms hallucinations and delusions (Björkly, 2002a; 2002b), and disorganization symptoms (Lysaker et al., 2005; Lysaker et al., 2012). Finally, we

predicted that metacognition would mediate the relationship between symptom severity and social functioning. It is important to note that our intention is not to examine what causes criminal behaviour, but rather to gain insight into how metacognition, symptom severity and social functioning are related in schizophrenia patients with a history of criminal behaviour.

2. Methods

2.1 Participants

Seventy-nine patients fulfilling the diagnostic criteria for schizophrenia (WHO, 1993) participated in the study. Patients were enrolled from both in- and out-patient facilities around Denmark. All patients had a history of criminal behaviour as indicated in the patients' official criminal record. All 79 participants signed written informed consent prior to participation. The study was approved by the Danish Ethical Committee and was carried out in accordance with the latest version of the Declaration of Helsinki. Demographic features of the participants are listed in Table 1.

(Insert Table 1)

2.2 Measures

The abbreviated version of the *Metacognitive Assessment Scale (MAS-A)* (Semerari et al., 2003) is a rating scale developed to measure metacognition. The scale consists of four subcomponents: *Self Reflectivity* or the comprehension of one's own mental states, *Understanding the others' mind* or the comprehension of mental states of other individuals, *Decentration* or the ability to see that others can have independent motives and unique perspectives on life events, and *Mastery* or the ability to work through one's representations and mental states to implement effective action strategies in order to accomplish cognitive tasks or cope with problematic mental states. Each scale

consists of a series of steps, with increasing levels of complexity. The total score (or MAS-Total) range from 0-28 and is generated by summing the scores of the four subscales.

The MAS-A is normally applied to interview transcripts of the Indiana Psychiatric Illness Interview (IPII; Lysaker et al., 2002). However, given the violent record of these patients, we thought that an appropriate instrument to investigate their metacognitive capacities was an interview tapping into aspects related to psychopathy. Accordingly, we used sections of the video-recordings of the Psychopathy Checklist-Revised (PCL-R; Hare, 2003). Importantly, the sections of the PCL-R interview that were used to rate metacognition in this study did not include narratives about criminal episodes. Rather, the sections that were used recounted general life-narratives from childhood and interpersonal relations. Thus, we intentionally avoided the sections of the PCL-R interview that cover criminal behaviour and which could have elicited distress, threat, anger or paranoia. Under such circumstances, metacognition functioning may break down (Salvatore et al., 2012). Importantly, unlike interview transcripts, the use of video-recordings provides the rater with cues that can lead to a more correct assessment of the patient's ability to attribute and infer mental states, particularly when rating complex capacities involving irony or sarcasm which may not be evident in the transcript format. The rating of metacognitive abilities based on the manual developed for scoring these video-recordings has shown good inter-rater reliability ($ICC = 0.82$ $p < 0.01$).

The Hare Psychopathy Checklist-Revised (PCL-R; Hare, 2003) is a clinical construct rating scale based on a semi-structured interview, file-records and authority reports. It consists of 20 items that are rated on a 3-point scale (0, 1, 2), with total scores ranging from 0-40. Many studies confirm both good internal consistency and inter-rater reliability of the PCL-R (Hare, 2003). For the purpose

of this article, the PCL-R interview was only used to assess the patients' metacognitive abilities (see description above).

The Affect Grid (Russell et al., 1989) is a single-item scale intended to measure affect in relation to two dimensions; 1) pleasure-displeasure and 2) arousal-sleepiness. The scale has displayed good reliability, convergent and discriminant validity. The scale is used in this study to control for the potential effect of current affect state on the participants' metacognitive abilities (Bateman and Fonagy, 2011).

The Global Assessment of Functioning (GAF; APA, 2000) is a valid measure of social, psychological and occupational functioning and was placed on the 5th axis of the DSM-IV-TR. It has shown good psychometric properties (inter-rater reliability around .80) (Dworkin et al., 1990). For this study, the inter-rater agreement was good (ICC, $r = 0.80$, $p < 0.001$).

The Mini-International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1998) is a validated structured interview intended to measure 17 of the major clinical syndromes (placed on the former Axis-I of the DSM-IV-TR). It has shown good psychometric properties, including inter-rater (all kappa values above 0.75) and retest reliability (Sheehan et al., 1998). Inter-rater reliability for this study was good (ICC, $r = 0.78$, $p < 0.001$).

The Positive and Negative Syndrome Scale (PANSS; Kay et al., 1989) was developed to assess symptom severity in schizophrenia, specifically in relation to positive symptoms (which refers to an excess or distortion in normal functioning) and negative symptoms (referring to a diminution or loss of normal functions). It has shown good inter-rater reliability (above 0.80 for all scales) as well as

significant correlations with corresponding criterion measures. For the purposes of this study we were interested in five items: the positive symptoms “Hallucinations” and “Delusions”, the negative symptoms “Blunted Affect” and “Emotional Withdrawal” and “Conceptual Disorganization” (Bell et al., 1994). Using this scheme, the inter-rater reliability in this study was good (ICC, $r = 0.85$, $p < 0.001$).

(Insert Table 2)

2.3 Procedure

Patients who were 18 years of age or older and had a diagnosis within the schizophrenia spectrum disorders (F20-spectrum; WHO, 1993) were asked by primary health clinicians to take part in the study. All patients were informed about the nature of the study verbally and in written form prior to the initiation of the interviews. All participants were informed that it was voluntary to participate. From the 220 patients who were asked, 116 agreed. Eight were excluded due to exclusion criteria, which included having a diagnosed organic brain-disorder (as reported in the patient’s medical records), being under the influence of alcohol or drugs, or having acute psychotic symptoms at the time of assessment. Given the objective of this paper is to characterize the social functioning and metacognitive abilities in patients with a criminal background, an additional 29 patients with no history of criminal behaviour were excluded. The data reported in this article are thus for 79 patients with a history of criminal activity.

Data were collected in the following order: 1) Socio demographic information, 2) Axis-I disorders (M.I.N.I. interview), 3) Positive and Negative symptoms (PANSS interview) and metacognitive abilities (using the semi-structured interview of the PCL-R). The Affect Grid was administered before and after the PCL-R interview. Collateral information was gathered and

medical records were inspected to support the validity of the diagnostic process. Finally, the GAF rating was determined based on information obtained from the M.I.N.I.-interview, the PANSS and the PCL-R interviews, as well as based on relevant information collected from the patients' medical records and files, and primary health employees working with the patients.

The first author conducted and scored all the assessments and interviews. A trained clinical psychologist, who was blind to the purposes of this study independently, rated all measures for a sub-sample of 25 patients (31.6%) for the purpose of testing inter-rater reliability. Both raters had extensive training in administering and rating the various measures and tests used in the present study.

2.4 Statistical analysis approach

Initially, we conducted bivariate correlational analysis between metacognition, clinical variables, socio-demographic variables and social functioning. We included the four subscales of metacognition, although these were not a part of our explicit hypotheses, to explore if any of the subscales were more closely linked to social dysfunction. Then we performed partial correlational analysis of metacognition and social functioning, controlling for both clinical and socio-demographic variables. Next, we conducted regression analyses to examine the possible association between the patients' social functioning and their general metacognitive capacity. SPSS 20 for MAC was used for all correlational and logistic regression analyses.

Moreover, we conducted mediation analyses to examine whether metacognition mediated the relationship between symptoms and social functioning. The standard four-step criteria to measure mediation effect, as summarized by Kenny and Baron (Baron and Kenny, 1986) has been criticised (Hayes, 2009), suggesting that mediation should be measured by the size of the indirect effect and not by the lack of the direct effect. In accordance with the suggestions by Hayes for

causal steps analyses (Hayes, 2009), we performed structural equation analyses (SEM) that allow for the estimation of all variables simultaneously. The total, direct, and indirect effects were calculated. We should note that when assessing mediation, it is important to make a distinction between the various effects and their corresponding weights. The *total effect* (weight c) of an independent variable (IV) on the dependent variable (DV) is composed of a *direct effect* (c') of IV on DV and an *indirect effect* (weight $a \times b$) of the IV on DV through a proposed mediator (M). Weight a represents the effect of IV on M and weight b is the effect of M on DV partialling out the effect of IV. In the current analysis, we employed a bootstrapping method (with $n=5000$ bootstrap re-samples) to assess the indirect effect. Bootstrapping is a non-parametric resampling procedure that generates an empirical approximation of the sampling distribution of the statistics of the available data. More specifically, the bootstrapping sampling distributions of the indirect effects are empirically generated by taking a sample (with replacement) of size n from the full dataset and calculating the indirect effects in the resamples. This way, point estimates and 95% confidence intervals are estimated for the indirect effects. As a stringent test of our hypothesis, we considered point estimates of indirect effects significant when zero is not contained in *all* confidence intervals. We used bias-corrected (BC) bootstrapping. Although criticism has been raised towards using mediation analysis on cross sectional data (Cole and Maxwell, 2003), comprehensive statistical arguments have been put forward acknowledging the use of mediation analysis in cross-sectional data (see MacKinnon, 2008). Mediation analyses were conducted in Mplus version 7.0 for MAC.

3. Results

3.1 Preliminary analysis

Since the metacognition score was a central measure in this study, we first tested whether present emotional state, measured by the Affect Grid before and after the PCL-R interview, affected

the metacognition score (i.e., the MAS-Total score). There was no significant relationship between the MAS-Total and the Affect Grid score ($r = 0.16, p < 0.16$). Next, we performed correlational analyses to investigate if any of the socio-demographic and clinical variables were related to metacognition and social functioning. As seen in Table 3, the sample's scores on social functioning and metacognition are variably related to socio-demographic as well as clinical variables.

(Insert Table 3)

To examine whether the relationship between metacognition and social functioning was affected by demographic and clinical variables, we conducted a partial correlation controlling for gender, age, ethnicity, education level, socioeconomic status, and the presence of: Depression (current and lifetime), Dysthymia, Hypomanic Episode, Manic Episode, Panic disorder (current and lifetime), Agoraphobia (current), Social Phobia (current), Obsessive-compulsive Disorder (current), Posttraumatic Stress Disorder (current), Generalized Anxiety Disorder, and Alcohol abuse. The results revealed that social functioning remained significantly related to MAS-Total ($r = 0.27, p = .02$). Given these results, clinical and demographic variables were partialled out in subsequent analyses.

3.2 Social functioning as a function of metacognitive abilities

We conducted linear regression analyses to assess the utility of the MAS-Total in predicting social functioning. The overall model for the regression analysis with MAS-Total was significant ($F = 4.74, p = 0.03, R^2 = 0.06$). It revealed that higher metacognition was associated with better social functioning ($\beta(\text{se}) = 0.24(0.14), p = 0.03$), explaining 6% of the variance.

3.3 Metacognition mediates the relationship between psychotic symptoms and social functioning

Mediation analyses were conducted to determine whether metacognition mediated the relationship between the PANSS symptoms that were only significantly correlated with social functioning, i.e. Delusions ($r = -0.23$, $p < 0.05$) and Conceptual Disorganization ($r = -0.31$, $p < 0.01$). We first examined whether metacognition mediated the relationship between Delusions and social functioning as measured by the GAF. The results revealed a significant total effect size of Delusions on social dysfunction (total effect = -1.80 , $p < 0.001$, 95% BC bootstrap CI -3.00 , -0.51). The analysis also revealed a significant indirect effect (point estimate = -0.20 , 95% BC bootstrap CI -0.56 , -0.001), suggesting that metacognition mediates the relationship between Delusions and social dysfunction, explaining 11% of the total effect between Delusions and social dysfunction. With respect to the association between Conceptual Disorganization and social functioning, the analysis indicated a significant total effect size of Conceptual Disorganization on social dysfunction (total effect = -1.87 , $p < 0.000$, 95% BC bootstrap CI -2.96 , -0.75), but a non-significant indirect effect (point estimate = -0.31 , 95% BC bootstrap CI -0.93 , 0.10), indicating that metacognition did not mediate the relationship between Conceptual Disorganization and social dysfunction.

(Insert Table 4)

(Insert Figure 1 and Figure 2)

4. Discussion

In this study, we sought to explore whether decreased metacognition would be related to lower levels of social functioning and severity of positive, negative and disorganization symptoms in a sample of schizophrenia patients with a history of criminal behaviour. We additionally examined whether metacognition would mediate the relationship between these symptoms and poor

social functioning. As predicted, poorer levels of metacognition were linked to poor social functioning and more severe levels of conceptual disorganization and delusions. Our findings are consistent with previous work reporting that metacognition is impaired in patients with schizophrenia and tends to be a persistent feature in chronic patients (Hamm et al., 2012). They are also consistent with work in non-forensic settings suggesting that metacognitive compromise is strongly related with disorganization symptoms which, to some extent, is independent of the influence of neurocognitive functioning or other symptoms (Brune et al., 2011). In line with earlier findings, we did observe a negative link between functional outcome and positive symptoms (McLeod et al., 2014), but not with negative symptoms. The lack of this association in our study could be due to the fact that in this population negative symptoms are less of an issue, since these patients are particularly more prone to acting out than to withdrawal.

Furthermore, the meditation analysis showed that metacognition accounted for about 11% of the total effect size of the association between delusions and social dysfunction, suggesting that the relationship between delusions and social dysfunction is partially driven by impaired metacognition. This has important clinical implications whereby targeting metacognitive functions can ameliorate social dysfunction precipitated by delusions. Thus, it can be suggested that reducing delusions and strengthening social functioning in patients might be achieved by addressing treatment directly at the functional level of metacognition.

Moreover, two interesting results emerged from our exploratory analyses assessing the relationship between the four metacognitive subscales and the clinical measures included in this study (Table 3). First, we found that the negative relationship between conceptual disorganization and metacognition can be attributed to the significant relationship of conceptual disorganization with the MAS-Self subscale ($r = -0.25, p < 0.05$), with the MAS-Other subscale ($r = -0.32, p < 0.05$) and the MAS-Mastery subscale ($r = -0.30, p < 0.01$). We also found that the negative

relationship between delusions and metacognition can be attributed to the significant relationship of delusions with the MAS-Mastery subscale ($r = -0.23, p < 0.01$). Secondly, although no overall significant relationship was observed between Passive/Apathetic Social Withdrawal and the MAS-Total, a negative and significant relationship emerged between Passive/Apathetic Social Withdrawal and the MAS-Decentration subscale ($r = -0.25, p < 0.05$). The specific relationships between clinical measures and the subscales of metacognition need to be further examined in future research, since looking at individual's overall metacognitive ability may not be sufficiently sensitive to discern the potential association of symptoms with specific subcomponent processes of metacognition.

While the cross sectional nature of our study precludes drawing any causal conclusions, the results pose a number of possibilities for future research. One can hypothesize that the patients' difficulties in making sense of the memories of violence evoked by the interview are precipitated by arousals engendered by a hyperactive fight/flight system (Sinclair and Gansler, 2009). One can contend, however, that there was no evidence of arousal disturbance, as measured by the affect grid. A possible answer is that the participants were aroused but unable or unwilling to disclose the information. Therefore, laboratory studies using a more direct measure of arousal such as skin conductance and heart rate are needed to see if poor metacognition is linked to heightened arousal in this and other populations.

This study has some limitations. It is important to note that causality cannot be inferred from the current findings due to the retrospective nature of the study. Accordingly, prospective studies are needed to further ascertain the specific relationship we report here between metacognition, social dysfunction and clinical variables. In addition, we were only able to consent roughly one half of those approached and thus it is unknown whether the same pattern of relationships between metacognition and outcome would be found among those who refused to participate. Furthermore,

some assessment sessions were conducted at institutions and others in the patients' homes, which could have skewed the patients' responses. It would have desirable to include a comparison group of schizophrenia patients without a history of criminal behaviour to explore any differences between these two groups. Utilizing the GAF as a measure of psychosocial functioning could be problematic, since it is primarily a measure of global functioning that does not exclusively evaluate psychosocial functioning. Future studies could benefit from the inclusion of additional measures that are specifically tailored to evaluating psychosocial functioning. Lastly, we employed a shortened version of the PANSS and thus did not obtain the fullest portrait of the patients' psychopathology.

With replication, there may be clinical implications. As noted above, this is a group of patients with particularly long-term poor outcomes, and abstaining from offending may depend upon their ability to function in their communities. This underscores the importance of interventions designed to enhance the patients' metacognitive capacities, that is, the more proximal capacities linked to social functioning. These include group- and individual-based approaches for which there is, so far, promising evidence from rich case studies and open trials (Van Donkersgoed et al., 2014).

Financial Disclosures

The authors declare no conflict of interest.

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- Metacognition predicts social functioning in schizophrenia patients with criminal behavior
- Positive symptoms predict social functioning in patients with criminal behavior
- Metacognition mediates the link between delusions and social functioning

Accepted manuscript

Table 1. Demographic features of the schizophrenia patients

Demographics		Sample (N= 79)
Age (Mean±SD)		36.9±10.4
Range in years		18-63
Gender	Male	64 (81.0%)
	Female	15 (19.0%)
Ethnicity	Danish	67 (84.8%)
	Immigrant	9 (11.4%)
	Descendent	3 (3.8%)
Educational level		
Not finished primary and/or secondary school		20 (25.3%)
Completed primary and secondary school		35 (44.3%)
Completed high School		7 (8.9%)
Completed higher education (3<years)		17 (21.5%)
Employment		
Employed		4 (5.1%)
Unemployed		8 (10.1%)
Disability pension		67 (84.8%)
Receiving anti-psychotics		75 (94.9%)

Table 2. Clinical scores for the schizophrenia patients

Clinical measures		Sample (N=79)
GAF^a		41.5 (6.7)
M.I.N.I (number of major Axis-I disorders) ^{a,b}		1.8 (1.6)
PANSS Total^a		14.5 (5.5)
PANSS items^a	P1- Delusions	1.9 (1.3)
	P2- Conceptual Disorganization	1.9 (1.1)
	P3- Hallucinatory Behaviour	1.9 (1.4)
	N1- Blunted Affect	2.0 (1.3)
	N4- Passive/Apathetic Social Withdrawal	2.1 (1.2)
MAS-Total^a		11.7 (3.2)
MAS subscales^a	<i>MAS-Self</i>	4.0 (1.2)
	<i>MAS-Other</i>	3.4 (1.3)
	<i>MAS-Decentration</i>	1.0 (0.6)
	<i>MAS-Mastery</i>	3.2 (1.5)
Alcohol abuse (current) ^c		22 (28 %)
Affect Grid before^a		5.2 (0.9)
Affect Grid after^a		5.3 (0.9)

^a Mean (SD)^b Counting: Depression (current and lifetime), Dysthymia, Hypomanic Episode, Manic Episode, Panic disorder (current and lifetime), Agoraphobia (current), Social Phobia (current), Obsessive-compulsive Disorder (current), Posttraumatic Stress Disorder (current), Generalized Anxiety Disorder.^c Number of patients having the disorder

Table 3. Spearman's rho correlational analyses of metacognition with social functioning and the sample's demographic and clinical variables

	MAS- Total	MAS- Self	MAS- Other	MAS- Decentration	MAS- Mastery	GAF Total
Gender [†]	0.24*	0.17	0.05	0.00	0.32**	0.03
Age	0.03	0.00	-0.03	-0.01	0.08	-0.28*
Ethnicity ^{††}	-0.23**	-0.33**	-0.19	0.18	-0.14	0.07
Employment	-0.30**	-0.25*	-0.31*	0.30**	-0.15	-0.17
Educational level	0.30**	0.40**	0.33**	-0.05	0.04	0.02
PANSS P1 - Delusions	-0.23*	-0.20	-0.18	-0.01	-0.23*	-0.35**
PANSS P2 - Conceptual Disorganization	-0.41**	-0.25*	-0.32*	-0.01	-0.30**	-0.31**
PANSS P3 - Hallucinatory Behaviour	-0.08	-0.04	-0.08	-0.04	-0.10	-0.14
PANSS N1 – Blunted Affect	0.06	0.02	0.08	-0.20	0.07	-0.02
PANSS N4 - Passive/ Apathetic Social Withdrawal	-0.06	0.00	0.05	-0.25*	-0.11	-0.19
M.I.N.I (number of major Axis-I disorders)	0.21	0.20	0.23**	-0.15	0.16	-0.13
Alcohol Abuse (current)	0.21	0.20	0.23*	0.00	0.20	0.38**
GAF Total	0.35**	0.20	0.23**	-0.03	0.39**	----

*Correlation is significant at the level of .05 (two-tailed).

**Correlation is significant at the level of .01 (two-tailed).

[†] Female participants were associated with better performance.

^{††} Ethnic Danish participants were associated with better performance, compared to non-Danish ethnic participants.

Table 4. Summary of mediation analysis with metacognition and social cognition

Independent variable (IV)	Mediating variable (<i>M</i>)	Dependent variable (DP)	Effect of IV on <i>M</i> (<i>a</i>)	Effect of <i>M</i> on DV (<i>b</i>)	Indirect Effect/ point estimate (<i>a</i> x <i>b</i>)	BC 95%CI for point estimate		Direct Effect (<i>c'</i>)	Total Effect (<i>c</i>)
						Lower	Upper		
Delusions	MAS-Total	GAF	-0.54*	0.36	-0.20*	-0.56	-0.001	-1.60*	-1.80*
Conceptual Disorganization	MAS-Total	GAF	-1.06*	0.30	-0.32	-0.93	0.10	-1.56*	-1.87*

* Significant point estimate (0 not contained in the 95% bootstrap CI)

Figure 1. Mediation analyses with metacognition, social functioning and delusions

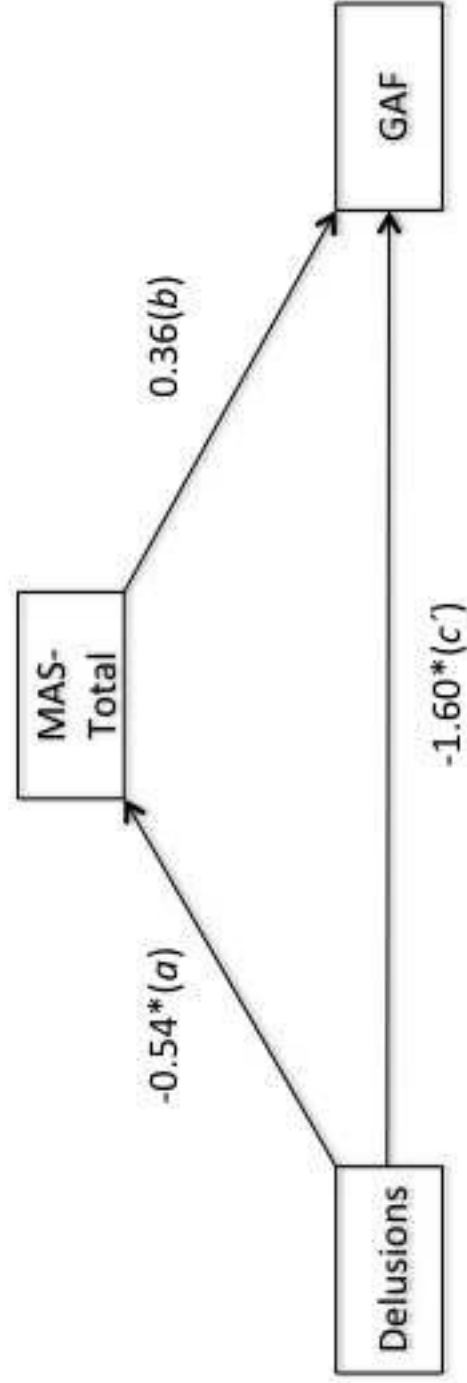


Figure 2. Mediation analyses with metacognition, social functioning and conceptual disorganization

